CREOSOTE: ENVIRONMENTAL EXPOSURE AND MODELING

I Background

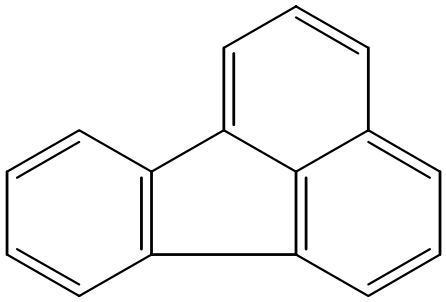
Creosote is a complex mixture of at least 160 detectable hydrocarbons and all 18 major components are cyclic and aromatic. About 80% of creosote is composed of poly cyclic aromatic hydrocarbons (PAH). One of the major uses of creosote is on crossties and switch ties. Over 99% of all crosstie and switch tie materials are treated with creosote solutions. The average service life for creosote treated crossties is 30 years. Because of the possible run off of creosote from the crossties, there are concerns about the environmental effects of creosote on aquatics. The Risk Assessment and Science Support Branch (RASSB) has decided to calculate the Estimated Environmental Concentrations (EECs) for four major component of creosote. These compounds are Fluoranthene, Chrysene, Benzo[a]pyrene and pyrene. The GENNEC (GENric Expected Environmental Concentration) is used to calculate EECs. The detailed descriptions of assumptions and inputs used in the model as well as the results are discussed in this report.

II Physical/chemical characteristics for several Poly cyclic Aromatic Hydrocarbons (PAHs) in Creosote

1. Chemical Name: Fluoranthene

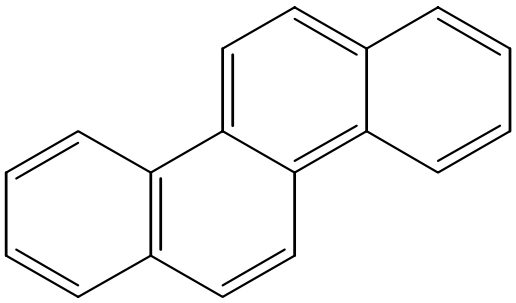
Molecular Weight:	202.3
Vapor Pressure:	8.7E-3 Pa
Solubility:	2.6E-4 mg L^{-1}
Log K_{ow} :	5.22
Henry's Law Constant:	1.037 Pa M^{3} $mole^{-1}$
Half Life:	
Water:	63 Hours
Sediment:	4800 Hours
Leachate:	1880 mg Kg^{-1}
K_{oc} :	66383

Fluoranthene



2. Chemical Name: **Chrysene**

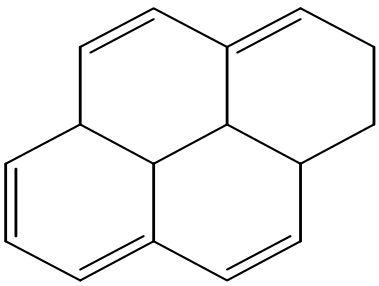
Molecular Weight:	228.2
Vapor Pressure:	1.7E-4 Pa
Solubility:	-
Log K_{ow} :	1.64
Henry's Law Constant:	5.86 Pa M^3 $mole^{-1}$
Half Life:	
Water:	4.4 Hours
Sediment:	1632 Hours
Leachate:	383 mg Kg^{-1}
K_{oc} :	44



Chrysene

3. Chemical Name: **Benzo[a]pyrene**

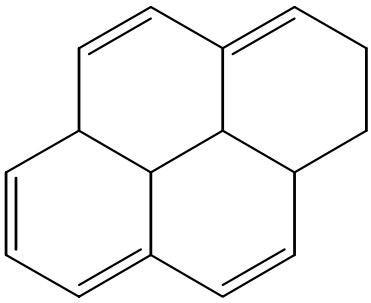
Molecular Weight:	252.3
Vapor Pressure:	2.13E-5 Pa
Solubility:	3.8E-6
Log K_{ow} :	1.64
Henry's Law Constant:	0.046 Pa M^3 $mole^{-1}$
Half Life:	
Water:	25 Hours
Sediment:	--
Leachate:	465 mg Kg^{-1}
K_{oc} :	1096478



Benzo[a]pyrene

4. Chemical Name: **Pyrene**

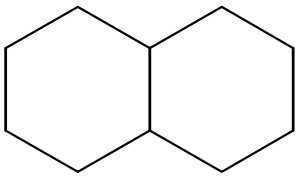
Molecular Weight:	202.3
Vapor Pressure:	1.19E-2 Pa
Solubility:	1.3E-4
Log K_{ow} :	5.18
Henry's Law Constant:	0.92 Pa M^3 $mole^{-1}$
Half Life:	
Water:	0.68 Hours
Sediment:	1652 Hours
Leachate:	1487 mg Kg^{-1}
K_{oc} :	151356



Pyrene

5. Chemical Name: **Naphthalene**

Molecular Weight:	128.2
Vapor Pressure:	---
Solubility:	3.1E-2
Log K_{ow} :	3.37
Henry's Law Constant:	43.01 Pa M^3 $mole^{-1}$
Half Life:	
Water:	71.0 Hours
Sediment:	---
Leachate:	3173 mg Kg^{-1}
K_{oc} :	961



Naphthalene

III <u>MODELING</u>

GENEEC is a screening model which provides an upper bound estimate of a chemical concentration in a one hectare (ha) pond which receives surface runoff from a 10 ha field after application of the chemical at the highest labeled seasonal applicarion rate.

The assumptions used in the GENEEC are:

a. A runoff event occurs two days after the last application of the chemical,

b. Ten percent of the remaining chemical application is transported from the field into the pond,

c. Spray drift equal to 1% of the ground application and 5% of aerial application of the chemical enters the pond,

d. The site for applications is considered a high exposure site for runoff water events, and is based on a site in Mississippi with high runoff potential.

e. Once the chemical has been transported to the pond, the model allows for degradation of the chemical based on a laboratory determined aerobic aquatic or soil metabolism of K_d value.

Other Assumptions:

1. A rail road crosses a 10 ha filed . There are two sets of rails in the same field. The crossties are treated with creosote.

2. The length of each rail road is 1476 feet.

3. The average dimensions of a crosstie are 7 inches by 9 inches by 8.5 feet.

4. The average surface area of a crosstie will be 0.627 m^2

5. It is assumed that all of the chemical in question will be leached out of the crosstie.

VI RESULTS

On the basis of the above assumptions, the amount of leached out chemical was converted to pounds per acre and was used as application rate in GENEEC. Only one application per year was used.

GENEEC provides a maximum concentration, 4 day average, 21 day average and 56 day average concentration for each chemical. The results of are shown in the following Table.

Surface Water Estimated Environmental Concentrations from GENEEC

Chemical	Application Rate (Lb ai/ac/year)	Maximum Concentration (PPT)	4-Day Average Concentration (PPT)	21-Day Average Concentration (PPT)	56-Day Average Concentration (PPT)
Fluoranthene	**0.563**	**260.0**	**232.5**	**45.0**	**16.9**
Pyrene	**0.446**	**130.0**	**130.0**	**36.4**	**13.7**
Naphthalene	**0.951**	**12.3**	**5.1**	**1.0**	**0.4**
Benzo[a]pyrene	**0.139**	**3.8**	**3.8**	**3.8**	**1.8**
Chrysene	**0.115**	**0.0**	**0.0**	**0.0**	**0.0**

These results indicate that the PAHs have the potential to move to surface water, however, the concentrations are very low and all are in parts per trillion. These chemicals were chosen on the basis of the availability pertinent data to run the model.

As previously indicated all of these estimates are based on the maximum leaching rate of each chemical from crossties. The results reported here are upper bound estimates based on conservative assumptions used in the model. The rates used in the application model are highest application rate on the label.

It should be mentioned that PAHs, the major constitutes of creosote, generally are adsorbed to soil particles and sediments and have low water solubility and limited mobility. Therefore, the effect of creosote on ground water and drinking water is expected to be minimal.